

WHAT IS CLAIMED IS:

1. A three-dimensional image forming method for forming a three-dimensional image having undulation corresponding to a three-dimensional object on a support using an ink jet system, comprising:

forming as a two-dimensional image a first layer image including said three-dimensional object on said support based on two-dimensional image information;

securing said first layer image on said support;

acquiring first height information with which said undulation corresponding to said three-dimensional object are reproducible on said support;

forming a lamination image of said three-dimensional image having said undulation corresponding to said three-dimensional object by laminating ink solid ejected using said ink jet system on said first layer image secured on said support based on said acquired first height information; and

fixing said lamination image of said three-dimensional image formed on said first layer image and having said undulation corresponding to said three-dimensional object.

2. The three-dimensional image forming method according to claim 1, wherein said first layer image is formed using an ink jet system that is the same as or different from said ink jet system used to form said lamination image of said three-dimensional image.

3. The three-dimensional image forming method according to claim 1, wherein
said lamination image of said three-dimensional image is formed using an ink jet system that is capable of laminating said ink solid by ejecting ink containing a thermoplastic solid or ultraviolet cure ink, and
said first layer image is formed using an ink jet system that is capable of forming a two-dimensional image by ejecting water-based ink, oil-based ink or ultraviolet cure ink for image recording.

4. The three-dimensional image forming method according to claim 1, wherein first fixation processing performed to secure said first layer image on said support and second fixation processing performed to fix said lamination image of said three-dimensional image formed on said first layer image are different from each other.

5. The three-dimensional image forming method according to claim 1, wherein said step of acquiring said first height information comprises the steps of:

acquiring second height information concerning a height of said three-dimensional object from inputted three-dimensional object information; and

converting the acquired second height information into desired height information with which said undulation corresponding to said three-dimensional object are reproducible on said support as said first height information.

6. The three-dimensional image forming method according to claim 5, wherein

said three-dimensional object information includes three-dimensional shape information concerning said three-dimensional object, and

said second height information is information concerning a height in said three-dimensional shape information.

7. The three-dimensional image forming method according to claim 5, wherein said two-dimensional image information is two-dimensional image data inputted in

addition to said three-dimensional object information.

8. The three-dimensional image forming method according to claim 5, wherein said two-dimensional image information and said three-dimensional object information are acquired from said inputted three-dimensional image information.

9. The three-dimensional image forming method according to claim 1, wherein

said two-dimensional image information is inputted information, and

said step of acquiring said first height information comprises the step of:

calculating as said first height information desired height information, with which said undulation corresponding to said three-dimensional object and corresponding to at least one part of positions on said first layer image are reproducible on said support, from the inputted two-dimensional image information.

10. The three-dimensional image forming method according to claim 1, wherein

said two-dimensional image information is inputted

information, and

said step of acquiring said first height information comprises the steps of:

calculating third height information corresponding to at least one part of positions on said first layer image from the inputted two-dimensional image information; and

converting the calculated third height information into desired height information with which said undulation corresponding to said three-dimensional object are reproducible on said support as said first height information.

11. The three-dimensional image forming method according to claim 1, wherein said step of acquiring said first height information comprises the steps of:

acquiring second height information concerning a height of said three-dimensional object from inputted three-dimensional object information, and

converting the acquired second height information based on human's visual characteristics into desired height information with which said undulation corresponding to said three-dimensional object are reproducible on said support.

12. The three-dimensional image forming method according to claim 11, wherein

said three-dimensional object information includes three-dimensional shape information concerning said three-dimensional object, and

said second height information is information concerning a height in said three-dimensional shape information.

13. The three-dimensional image forming method according to claim 11, wherein said two-dimensional image information is two-dimensional image data inputted in addition to said three-dimensional object information.

14. The three-dimensional image forming method according to claim 11, wherein said two-dimensional image information and said three-dimensional object information are acquired from inputted three-dimensional image information.

15. The three-dimensional image forming method according to claim 11, wherein said step of converting said second height information based on the human's visual characteristics comprises the step of:

determining a height frequency based on a grainy feeling or a glossy feeling, which is to be felt with human's sense of sight, obtained using samples having different surface roughness.

16. The three-dimensional image forming method according to claim 11, wherein said step of converting said second height information based on the human's visual characteristics comprises the step of:

converting a height gradation in accordance with a height resolution visibility curve.

17. The three-dimensional image forming method according to claim 16, wherein said step of converting said height gradation in accordance with said height resolution visibility curve is performed so that selective enhancement or suppression is performed in a region in which said human's sense of sight is enhanced.

18. The three-dimensional image forming method according to claim 16, wherein said step of converting said height gradation in accordance with said height resolution visibility curve is performed so that information cut is performed in a region in which said human's sense of sight

loses substantial sensitivity.

19. The three-dimensional image forming method according to claim 1,

wherein said two-dimensional image information is inputted information, and

said step of acquiring said first height information comprises the step of:

calculating desired height information, with which said undulation corresponding to said three-dimensional object and corresponding to at least one part of positions on said first layer image are reproducible on said support, from said inputted two-dimensional image information based on human's visual characteristics.

20. The three-dimensional image forming method according to claim 1, wherein

said two-dimensional image information is inputted information, and

said step of acquiring said first height information comprises the steps of:

calculating third height information corresponding to at least one part of positions on said first layer image from said inputted two-dimensional image information, and

converting the thus calculated third height information based on human's visual characteristics into desired height information with which said undulation corresponding to said three-dimensional object are reproducible on said support.

21. A three-dimensional image forming apparatus for forming a three-dimensional image having undulation corresponding to a three-dimensional object on a support using an ink jet system, comprising:

first forming means for forming as a two-dimensional image a first layer image including said three-dimensional object on said support based on two-dimensional image information;

securing means for securing said first layer image on said support;

first information acquiring means for acquiring first height information with which said undulation corresponding to said three-dimensional object are reproducible on said support;

second forming means for forming a lamination image of said three-dimensional image having said undulation corresponding to said three-dimensional object by laminating ink solid ejected using said ink jet system on

said first layer image secured on said support based on the acquired first height information; and

a fixing means for fixing said lamination image of said three-dimensional image formed on said first layer image and having said undulation corresponding to said three-dimensional object.

22. The three-dimensional image forming apparatus according to claim 21, wherein said first forming means and said second forming means are each an ink jet head using a same or different ink jet system.

23. The three-dimensional image forming apparatus according to claim 21, wherein

said second forming means is an ink jet head that forms said lamination image of said three-dimensional image having said undulation corresponding to said three-dimensional object by laminating said ink solid through ejection of ink containing a thermoplastic solid or ultraviolet cure ink, and

said first forming means is an ink jet head that forms a two-dimensional image by ejecting water-based ink, oil-based ink or ultraviolet cure ink for image recording.

24. The three-dimensional image forming apparatus according to claim 21, wherein said securing means and said fixing means perform different fixation processing.

25. The three-dimensional image forming apparatus according to claim 21, wherein said first information acquiring means includes:

second information acquiring means for acquiring second height information concerning a height of said three-dimensional object from inputted three-dimensional object information; and

first information converting means for converting said second height information acquired by said second information acquiring means into desired height information with which said undulation corresponding to said three-dimensional object are reproducible on said support.

26. The three-dimensional image forming apparatus according to claim 21, wherein

said two-dimensional image information is inputted information, and

said first information acquiring means includes first information calculating means for desired height information, with which said undulation corresponding to

said three-dimensional object and corresponding to at least one part of positions on said first layer image are reproducible on said support, from said inputted two-dimensional image information.

27. The three-dimensional image forming apparatus according to claim 21, wherein

said two-dimensional image information is inputted information, and

said first information acquiring means includes:

second information calculating means for calculating third height information corresponding to at least one part of positions on said first layer image from said inputted two-dimensional image information, and

second information converting means for converting said third height information calculated by said second information calculating means into desired height information with which said undulation corresponding to said three-dimensional object are reproducible on said support.

28. The three-dimensional image forming apparatus according to claim 21, wherein said first information acquiring means includes:

said second information acquiring means for acquiring second height information concerning a height of said three-dimensional object from inputted three-dimensional object information; and

third information converting means for converting said second height information acquired by said second information acquiring means into desired height information with which said undulation corresponding to said three-dimensional object are reproducible on said support based on human's visual characteristics.

29. The three-dimensional image forming apparatus according to claim 21, wherein

said two-dimensional image information is inputted information, and

said first information acquiring means includes third information calculating means for calculating height information, with which said undulation corresponding to said three-dimensional object and corresponding to at least one part of positions on said first layer image are reproducible on said support, from the inputted two-dimensional image information based on human's visual characteristics.

30. The three-dimensional image forming apparatus according to claim 21, wherein

 said two-dimensional image information is inputted information, and

 said first information acquiring means includes:

 said second information calculating means for calculating third height information corresponding to at least one part of positions on said first layer image from said inputted two-dimensional image information; and

 fourth information converting means for converting said third height information calculated by said second information calculating means into desired height information with which said undulation corresponding to said three-dimensional object are reproducible on said support based on human's visual characteristics.